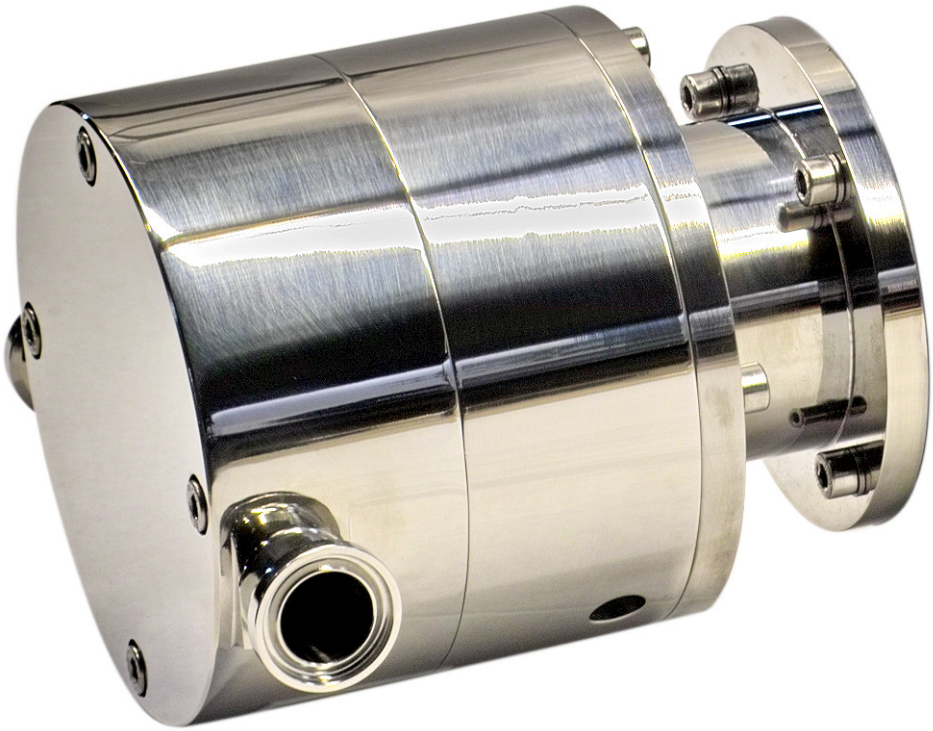
Service & Maintenance Manual

PUREFLO® 21 • 4-Piston Diaphragm Pump

591-1303 & 591-1303Z



INDEX

PUREFLO® 21-ENGLISH-09-2014

PUREFLO® 21 – Diaphragm Pump

Service- and Maintenance Manual

1 General Information

The PUREFLO® 21 – diaphragm pump is a positive displacement pump which can handle sensitive, water like and low viscous liquids.

The construction is made from stainless steel 316L (1.4404) and offers a high standard of hygiene and clean ability.

It is essential that anyone who will install, operate, or be involved with this equipment shall read the whole of this manual **before installing the pump**, as it contains important safety information. Failure to follow these instructions could result in damage of the pump or injury to yourself or other people.

Adherence to the procedures and specifications outlined in the following chapters will assist in providing economical and reliable operation throughout the life of the pump.

If service or repair other than described in this manual should become necessary, contact your supplier for assistance.

Any pump returned to the supplier for any reason must be fully cleaned and decontaminated and accompanied by details of what fluids have been pumped, including full Health and Safety Information (MSDS sheets) if any of those fluids are hazardous.

All figures in brackets (...) throughout this manual refer to the component key numbers used on the cross-sectional drawings and the spare parts lists.

1.1 Safety

Throughout this manual your attention is drawn to certain procedures which must be followed to ensure safe operation and servicing of this product.

DO NOT ignore safety instructions.

DO NOT remove by-pass or tamper with safety devices.

DO NOT use this equipment if the end cover (1) is removed, guards are missing or inlet & outlet pipe work is not connected.

DO NOT forget the hazards of moving parts, high fluid pressure, extremes of temperature, hazardous liquids, electricity. Always isolate and lock-out pump drive motor, before inspecting or servicing pump.

1.2 Technical Details

JABSCO'S PUREFLO® 4-piston diaphragm pump is designed to be used in pharmaceutical, biotech, food or cosmetic applications. The design complies with the stringent requirements of these Industries.
The system can be cleaned easily and the simple construction allows safe and easy use.

Typical Examples:
- Solutions containing proteins
- Suspension of cells
- Bacteria, yeast, fungi, mammalian cells
- Suspensions containing viruses
- Filtration, chromatography
- Feed pump for centrifuges and separators
- Feed pump for filter systems
- Ingredients for food and/or cosmetics

Features:
- Easy to clean, no shaft seals
- Can run dry, self priming
- Low noise, constant flow
- Compact and small
- Flow up to 1.400 l/h when used with converter
- Pressure up to 6,0 bar, in constant use 5,0 bar should not be exceeded
- Temperature up to 60° C in constant use, CIP up to 90° C is possible, SIP up to 135° C is possible
- Viscosity up to 250 Centipoise

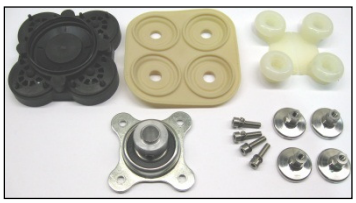
Parts in contact with fluid:
- Head — Stainless Steel 316L
- Diaphragm — Santoprene®
- Valves & O-Ring — EPDM
- Valve chamber — Polypropylene
- Pistons — Stainless Steel 316L, electro polish
- Ports — Tri-Clamp ¾"

Drive to be used:
- Motor — IEC-Motor, frame size 63 B3/B14 (foot & flange)
- Speed — 2,790 rpm or 1,390 rpm
- Motor power — 0,18 kW

Materials / Surfaces:
- Parts in contact with fluid are only manufactured from FDA conforming materials.
- 3.1 B certification is standard.
- Surface finish Ra < 0.8 µm standard, 0.5 µm and Electro polish is available on request.

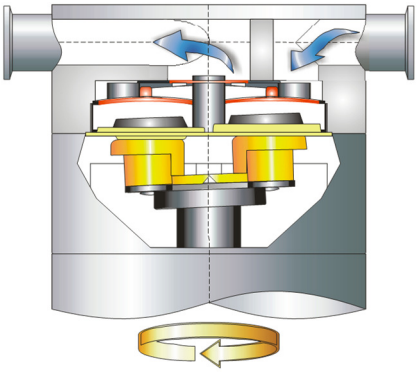
NEW!
Up till now we used pistons made from Polypropylene, these are now replaced with electro polished stainless steel pistons. The stainless steel pistons are 1:1 interchangeable.

OLD



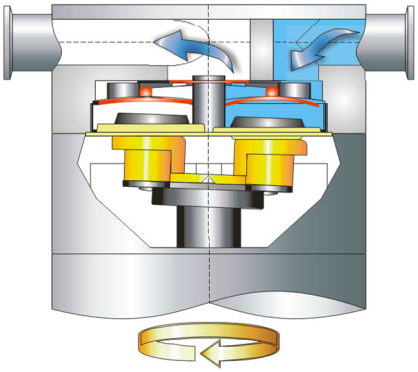
NEW

1.3 Principal of Operation



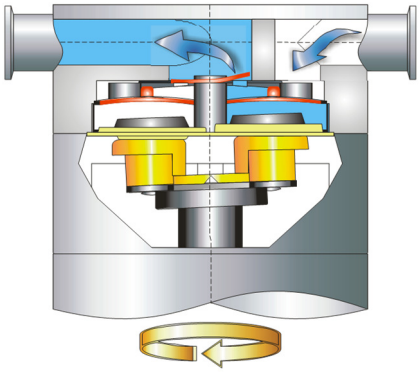
(1)

The self priming design allows pump to create suction to draw fluid into the pump without manual priming.



(2)

Fluid enters inlet port and is drawn through inlet check valve when piston moves away from the check valve assembly.



(3)

As piston moves toward the check valve, the fluid is forced through outlet check valve an out of pump.

1.4 Operating Conditions

PUREFLO® 21 – diaphragm pumps are designed using modern design techniques and manufactured from high quality materials. However, there are certain limitations to the operating conditions of the pump to ensure long life and trouble-free running. During pump selection and specification these limitations are taken into account and must not be exceeded.

Every pump is supplied with a Performance Data Sheet which gives details of these limitations. These are...

- Maximum **Pressure**
- Maximum **Temperature**
- Maximum **Viscosity**

These limitations and performance characteristics can vary with pump specification.

Take particular care over the following:

Materials: Ensure that all the fluids to be pumped, including cleaning and sterilizing agents, are compatible with materials from which the pump is constructed.

PURFELO® 21 – diaphragm pumps can be used for duties other than those for which the pump originally was selected but the new application must be checked against the Performance Data Sheet to ensure safe and reliable operation. Unless you have experience in the use of this Data Sheet, we strongly recommend that, if a change of duty is required, you contact the distributor who supplied the unit or the manufacturer.

1.5 Model – Numbering System

You will find the serial number (stamped on pump head). The documentation shows Model – Number and Serial – Number of the pump. The Serial – Number is unique to each pump.

The MODEL – NUMBER gives important information about the specification of the pump.

Both numbers should be quoted with all queries or orders of spares.

1.6 Inspection upon Receipt

PURFELO® 21 – diaphragm pumps are factory inspected and tested before packing and shipping, to ensure safe delivery and satisfactory service. We would, however, recommend that you carry out the following actions upon receipt of your pump.

a) Open package and remove packing material from container and check contents against packing list. Look carefully for small parts and special tools included.

b) Check the pump for any physical damage sustained in shipping. If loss or damage is found, notify your carrier and supplier immediately.

2 Installation

Careful attention to correct installation of PURFELO® 21 – diaphragm pumps, and recognition of certain limitations to the operating conditions of the pump, will ensure long life and trouble-free running.

Failure to follow these instructions could result in personal injury or loss of life. Take particular care over the following

2.1 Operating Limitations

PRIMING: Die PUREFLO® 21 – diaphragm pump is dry self priming and can be mounted above liquid level.

PRESSURE: Do not operate the pump above the maximum differential pressure shown on the Performance Data Sheet, not even for a few seconds, as damage to the pump components can be the result.

NEVER run the pump against a closed valve.

SOLIDS: PUREFLO® 21 – diaphragm pumps can handle soft solids in suspension but may be damaged by hard particles. Take care pumping solids, crystals, etc.

Never allow metal parts to enter pump, e.g. weld metal, screws, tools, etc. as these will stop the pump, leading to damage.

KAVITATION: The pumps cannot operate without sufficient pressure of the liquid at the inlet port of pump. Normally atmospheric pressure is sufficient. Limitations might be…

- High Viscosity's
- High Temperature
- High Pump Speeds
- Volatile Liquids

Insufficient inlet pressure will cause the pump to cavitate leading to low performance, noise and short pump life. Ensure inlet pipes are short, large bore and do not collapse under vacuum.

2.2 Location & Positioning

- As close as possible to the fluid source.
- In a clear area allowing access all around pump for easy servicing.

2.3 Guards and Safety

All moving parts must be guarded. Local safety regulations and codes of practice will specify the minimum acceptable standard.

2.4 Electrical

Electricity can cause injury or death. Follow good practice and local regulations.

In particular:


Connect pump in accordance with manufacturer's recommendations.


All electrical work must be carried out by competent personnel to local safety regulations and codes of practice.


Take special note of requirements of the area, e.g. hose-down, high humidity, explosion proof, etc. Always disconnect pump from power supply, before you carry out any service and maintenance.


Ensure equipment rating plate corresponds to supply.

2.5 Pipe Work

Pipe runs and sizes should be established at the time the pump is selected. When installing pump do not deviate from this design without rechecking pump selection.

- Keep pipe runs short and pipe diameters large.
- Inlet pipe must be as short as possible and as large bore as possible to prevent cavitation.
- Use large radius bends and full bore valves. Avoid globe or needle valves on viscous fluids.
- Fit isolation valves each side of the pump to simplify maintenance.
- Fit pressure gauges to monitor pressure conditions.

2.6 Materials in Contact with Fluid:

- Body, 316L (1.4404)
- Pistons, 316L (1.4404, Ra <0,5 µm, electro polish)
- Diaphragm, Santoprene® (FDA CFR21, 177.1210 & USP Class VI)
- Valves & O-Ring, EPDM (FDA CFR21, 177.2600 & USP Class VI)
- Valve Chamber, Polypropylene (FDA CFR21, 177.1520 & USP Class VI)

2.7 Overload Protection

- The unit is not equipped with an overload protection. The power supply should be protected appropriate.

3 Start Up & Routine Checks

3.1 Start Up

Before starting pump the first time or after servicing or maintenance work, check the following – failure to do so could damage equipment or cause injury to personnel.

- Mounting bolts (15) are tight and the pump body (1) is positioned correctly.
- All pipe connections are secure.
- All guards, safety and protection devices, are in place and effective.
- All valves are open – **NEVER** run pump against closed valve.
- Pipes and pump are clear of welding flash or other debris.
- Start pump slowly and increase speed gradually.
- Listen for unexpected noise.
- Check for leaks.
- Check that pump gives desired flow rate at normal operating speed.
- Do not continue to run pump if fluid is not flowing. Check if liquid is available, unit is plugged in.
- Observe pump during first few hours of operation – check for noises and excessive heating of pump.

All pump and equipment surfaces which become hot, i.e. above 60° C (140° F) during operation should carry warning labels.

3.2 Daily Checks

- Visual checks of all joints for signs of leakage of product, flushing liquid (if used).
- Listen and look for any unusual noises, vibration or temperature change.
- If minor problems are identified these should be rectified at the end of the shift and if major they should be attended to at once.

3.3 Weekly Checks

- As Daily Checks.
- Remove pump body (1); inspect diaphragm (7); O-Ring (5) and valve chamber (6). If there is any sever wear or damage replace parts.

3.4 Monthly Checks

- As Weekly Checks.
- Remove pump body (1); inspect diaphragm (7); O-Ring (5) and valve chamber (6). If there is any sever wear or damage replace parts.

3.5 Six Monthly Checks

- As Monthly Checks.
- Remove pump body (1); inspect diaphragm (7); O-Ring (5) and valve chamber (6). If there is any sever wear or damage replace parts.

3.6 Annual Checks

- As Monthly Checks.
- Remove pump body (1); inspect diaphragm (7); O-Ring (5) and valve chamber (6). If there is any sever wear or damage replace parts.
  But it is recommended to change wearing parts (service kit 20407031-S1) every 1.000 hours or once a year.

By ensuring a visual inspection daily and regular checks at planned intervals, pump can be maintained to maximum performance for many years.

4 Cleaning

PURFELO® 21 – diaphragm pumps are designed for use with products that require the process equipment and pump to be cleaned. The standards (level) of cleaning or sanitization required depends on the needs of the process and product. This information is provided for guidance only. It is the responsibility of the pump user to satisfy him- / her-self that the cleaning protocol chosen is adequate to achieve the desired levels of cleanliness and Jabsco cannot accept any responsibility for contamination or loss.

In order to clean the pump it must be cleaned in place (CIP) as part of the procedure for cleaning the entire process. The higher the standard required, the more sophisticated the cleaning process.

4.1 Cleaning in Place (CIP)

Cleaning Systems

The type of cleaning system used depends partly on the level of cleaning required but also on what is to be removed. Organic materials such as oils, fats, proteins need a different system to inorganic materials such as mineral salts. Detergent manufacturers can give advice on the correct use of chemicals and temperature. CIP usually needs a velocity of 1.5 m /sec (5 ft/sec) through the pipeline to achieve the turbulent flow required.

Procedure for Cleaning In Place (CIP)

Each pump is supplied in a generally clean condition but it is the responsibility of the user to establish suitable cleaning and sterilising regimes appropriate to the fluid and process. These should be implemented before the pump is first used and as often as required thereafter. The following guide lines will help with effective cleaning of PURFELO® 21 – diaphragm pumps and minimise risk of damage to the pump.

1. Rinse through system with a suitable liquid, usually water at approximately 50° C (120° F), as soon as possible after completion of process to remove bulk of residues before they dry onto surfaces.
2. If CIP will not be carried our immediately after rinsing, leave pump and system full of rinse liquid.
3. Choose chemical cleaning agents to suit nature of the contamination to be removed and use the in accordance with manufacturer's recommended dilution, temperature and circulation time but do not exceed 90° C (195° F). Confirm compatibility with pump materials of construction.
4. CIP fluid flow should result in a mean pipe line velocity of at least 1.5 m/sec (5 ft/sec).

4.2 Sterilising In Place (SIP)

A chemical sterilisation or sterilisation with steam up to 135° C is possible.

To achieve 100% sterility, it is important to steam through for a period long enough for the coldest part of the system to reach the correct temperature and hold for the time period required to kill off the organisms.

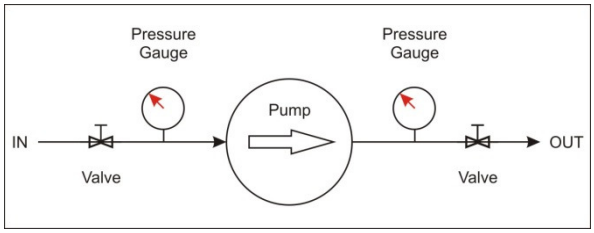
Procedure for Sterilizing In Place (SIP)

(If using chemical sanitizers, follow guidelines as for CIP above)

1. Thoroughly clean pump and process lines prior to sterilization.
2. Pass clean, wet steam through system until all component temperatures have stabilised. Steam must be free of scale, rust and particles - a filter may be necessary. Typically steam will be at 121℃ (250℉) and 1.0 bar / 15 psi (2.0 bar abs.). Soak time, to bring the pump up to temperature, is typically 20 minutes but this should be established, e.g. using thermocouples, as the required soak time will vary with individual installations.
3. Do not loosen or remove any pump components or pipe connections during steam sterilisation as escaping steam may cause serious injury.
4. Continue to pass wet steam through the pump and process lines during the hold time. Hold time will be determined by the user to achieve desired level sterility.

5. Typically this will be between 20 and 60 minutes.
6. The pump should rotate during SIP, so that all surfaces in contact with product are sterilized.

Always take care that the steam pressure is the same at the INLET and OUTLET of the pump. If you have a lower pressure on the OUTLET (inside the pump as well), the steam will evaporate and expand the volume and therefore the pressure extremely. This will damage the diaphragm and possibly other parts of the system.



4.3 Vapour Pressure Chart

°C	bar abs.	°C	bar abs.	°C	bar abs.	°C	bar abs.
2	0,01	61	0,21	120	1,99	178	9,58
3	0,01	62	0,22	121	2,05	179	9,81
4	0,01	63	0,23	122	2,12	180	10,04
5	0,01	64	0,24	123	2,18	181	10,27
6	0,01	65	0,25	124	2,25	182	10,51
7	0,01	66	0,26	125	2,32	183	10,75
8	0,01	67	0,27	126	2,40	184	11,00
9	0,01	68	0,29	127	2,50	185	11,25
10	0,01	69	0,30	128	2,55	186	11,50
11	0,01	70	0,31	129	2,62	187	11,76
12	0,01	71	0,33	130	2,70	188	12,02
13	0,02	72	0,34	131	2,79	189	12,29
14	0,02	73	0,36	132	2,87	190	12,57
15	0,02	74	0,37	133	2,96	191	12,84
16	0,02	75	0,39	134	3,04	192	13,13
17	0,02	76	0,40	135	3,13	193	13,41
18	0,02	77	0,42	136	3,23	194	13,71
19	0,02	78	0,44	137	3,32	195	14,00
20	0,02	79	0,46	138	3,42	196	14,31
21	0,03	80	0,47	139	3,52	197	14,61
22	0,03	81	0,49	140	3,62	198	14,93
23	0,03	82	0,51	141	3,72	199	15,24
24	0,03	83	0,53	142	3,83	200	15,57
25	0,03	84	0,56	143	3,93	201	15,89
26	0,03	85	0,58	144	4,05	202	16,23
27	0,04	86	0,60	145	4,16	203	16,57
28	0,04	87	0,63	146	4,27	204	16,91
29	0,04	88	0,65	147	4,39	205	17,26
30	0,04	89	0,68	148	4,51	206	17,62
31	0,05	90	0,70	149	4,64	207	17,98
32	0,05	91	0,73	150	4,76	208	18,35
33	0,05	92	0,76	151	4,89	209	18,72
34	0,05	93	0,79	152	5,03	210	19,10
35	0,06	94	0,82	153	5,16	211	19,48
36	0,06	95	0,85	154	5,30	212	19,87
37	0,06	96	0,88	155	5,44	213	20,27
38	0,07	97	0,91	156	5,58	214	20,67
39	0,07	98	0,94	157	5,73	215	21,08
40	0,07	99	0,98	158	5,88	216	21,50
41	0,08	100	1,01	159	6,03	217	21,92
42	0,08	101	1,05	160	6,19	218	22,34
43	0,09	102	1,09	161	6,35	219	22,78
44	0,09	103	1,13	162	6,51	220	23,22
45	0,10	104	1,17	163	6,67	221	23,67
46	0,10	105	1,21	164	6,84	222	24,12
47	0,11	106	1,25	165	7,02	223	24,58
48	0,11	107	1,30	166	7,19	224	25,05
49	0,12	108	1,34	167	7,37	225	25,52
50	0,12	109	1,39	168	7,55	226	26,00
51	0,13	110	1,43	169	7,74	227	26,49
52	0,14	111	1,48	170	7,93	228	26,99
53	0,14	112	1,53	171	8,12	229	27,49
54	0,15	113	1,58	172	8,32	230	28,00
55	0,16	114	1,64	173	8,52	231	28,51
56	0,17	115	1,69	174	8,73	232	29,04
57	0,17	116	1,75	175	8,93	233	29,57
58	0,18	117	1,81	176	9,15	234	30,11
59	0,19	118	1,86	177	9,36	235	30,65
60	0,20	119	1,92	178	9,58	236	31,21

5 Inspection and Repair

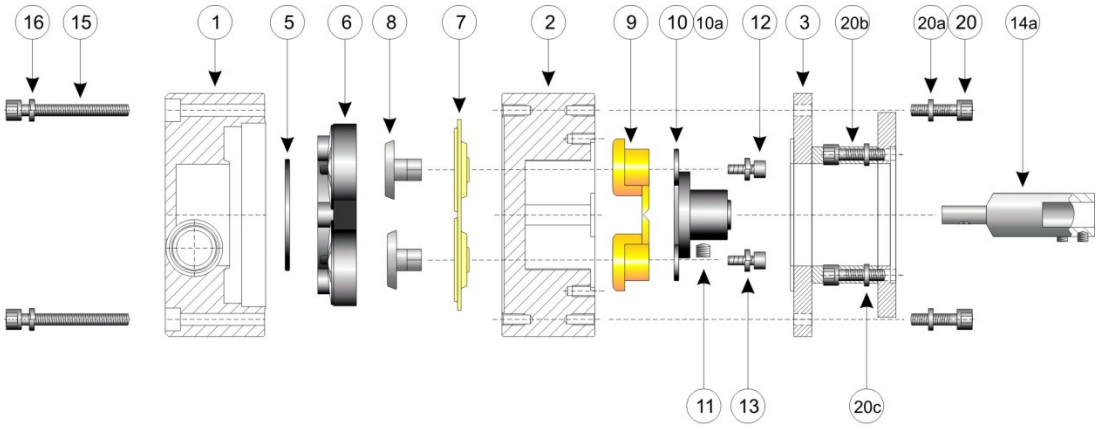
PURFELO® 21 – diaphragm pumps need no adjustment during normal operation. It is advisable though to inspect pump head components (especially seals and joints) periodically so that they may be cleaned or replaced before they fail in service.

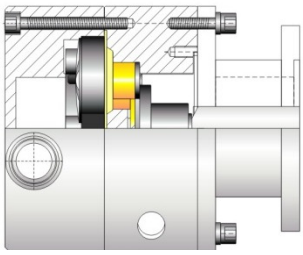
All main components can be inspected just taking the pump head (1) off.

For your safety:

Before commencing any repair or inspection, isolate power to pump. Depressurise, drain and isolate pipe work.

5.1 Pump Body





5.2 Disassembly of Pump Body

- Pump body (1) can be dismantled after loosening 4 screws (15) at pump flange (2). It is possible that valve chamber (6) and O-Ring (5) stick in pump body. These parts can be pulled out without use of any tools.
- To disassemble the diaphragm (7) you will need to pull the cam from the motor shaft. You need an Allen key ⅛" to do this (you will reach the cam screw through the drain hole).

- If you can't see the cam screw, you can press the single pistons so that the cam turns into a position you can access with the Allen key.
- Afterwards you need to loosen the 4 screws (12) of the cam (9), which keep the pistons (8) in the outer piston plate (9). You can now pull the 4 pistons (8) out of the diaphragm (7) and so you can change the diaphragm as well.

Assembly

- Check parts for wear or damage before assembly.
- Replace parts if necessary. Fit valve chamber (6) and O-Ring (5) in the pump body (1). Check that O-Ring (5) is in correct position. Fit pump body (1) to flange (2). Secure that pump body, diaphragm and flange are aligned properly. Fit 4 screws (15) in pump body (1) and tighten. There should be no gap between pump body (1) and flange (2). Both parts should have metal to metal contact.

5.3 Remove Pump from Electric Motor

Disassembly

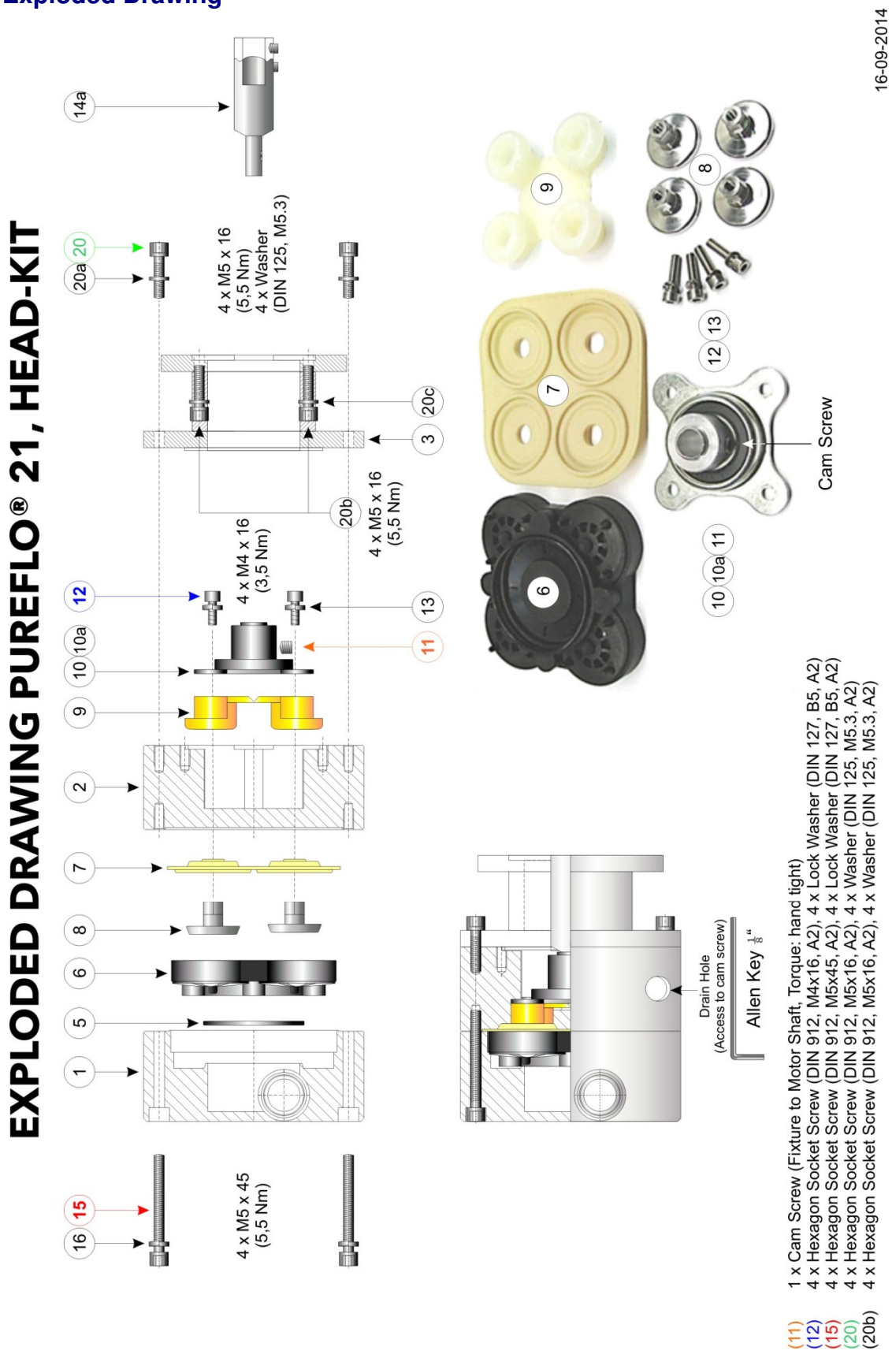
- Switch main switch OFF and pull plug before disassembly. Disconnect cables of motor from sockets.
- Remove 4 screws (20) from pump flange (3).
- Remove grub screw (11) of cam (10). This is done through drain holes of pump flange.
- If you can't see the cam screw, you can press the single pistons so that the cam turns into a position you can access with the Allen key.
- Disassemble pump body (1) (see Disassembly Pump Body 5.2).
- Remove 4 screws (20b) from motor. Remove 4 screws (12) of pistons (8). The pistons can now be pulled out of diaphragm (7) and the diaphragm can be removed as well.

5.4 Assembly of Pump onto Electric Motor

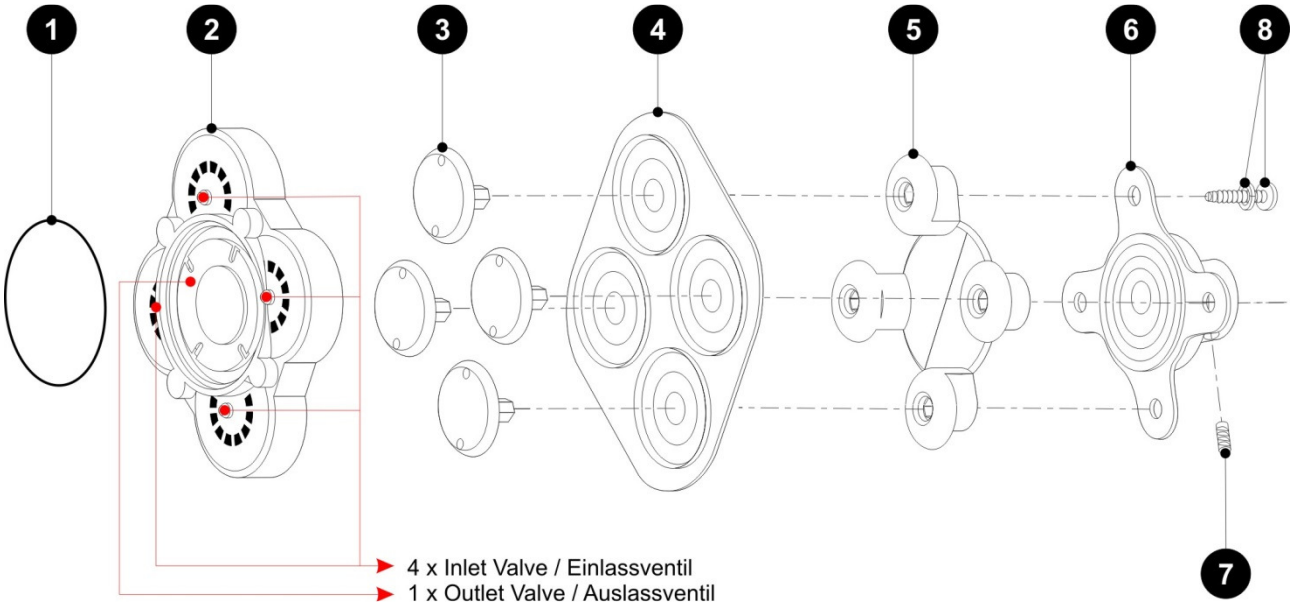
Assembly

- Check parts for wear or damage before assembly. Replace parts if necessary.
- Mount parts in opposite way as described under disassembly.
- Connect cables of motor to sockets.
- Check if function of unit is normal and all connections are tight.
- Carry out a cleaning regime before you use in production again.

5.5 Exploded Drawing



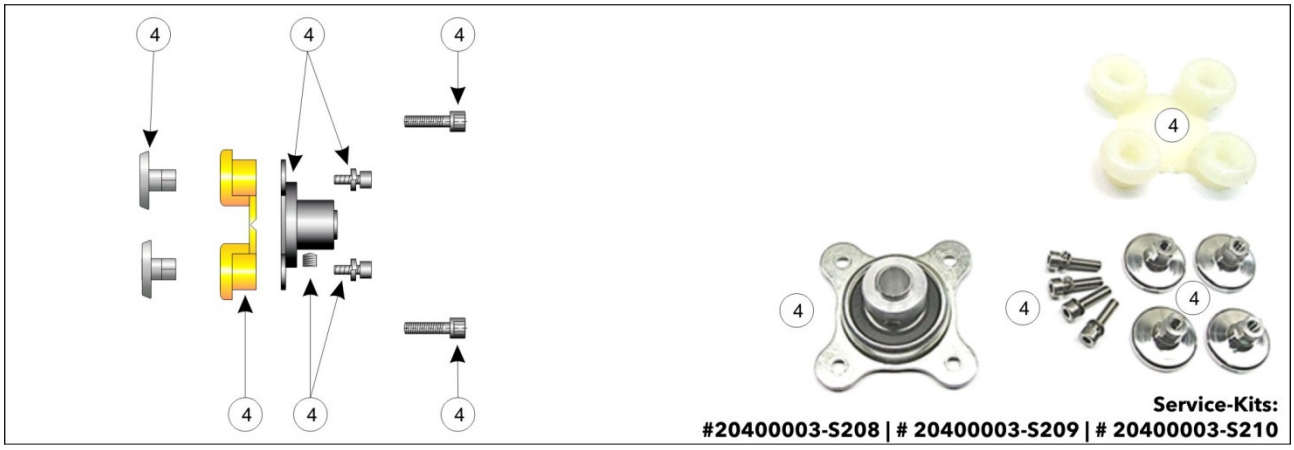
6 Wear Parts



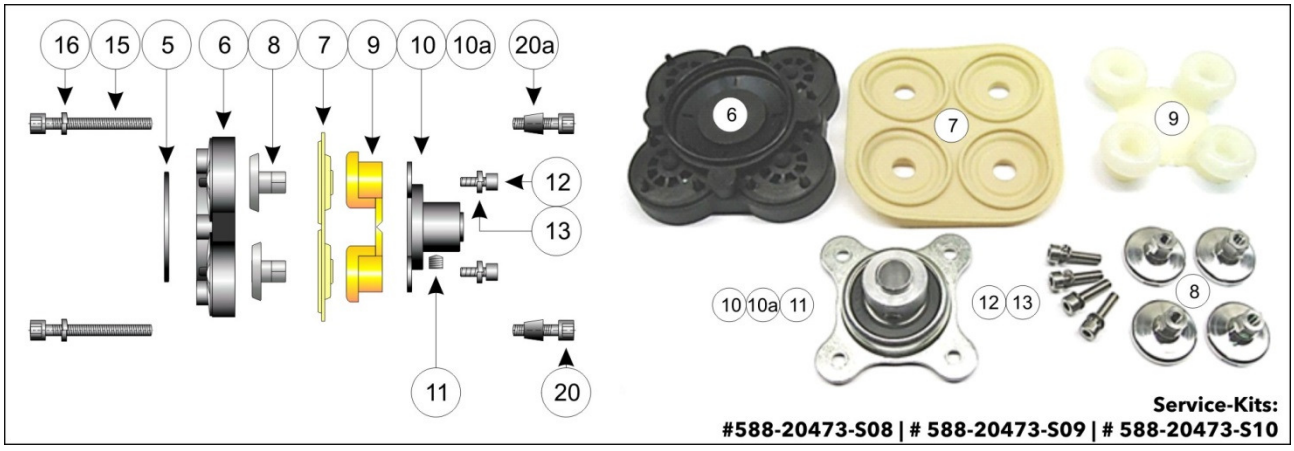
#	Part No.	Part of Kit	Description	Material	Product Contact	Qty.
1	A4N2205160	20407031-S1 20400003-S208 588-20473-S08	O-Ring 47,0 mm x 2,0 mm	EPDM	YES / JA	1
2	20407036	20407031-S1 20400003-S208 588-20473-S08	Valve Housing Kit / Ventilgehäuse Kit 20364031	Polypropylene	YES / JA	1
			- Chamber Valve Quad 20334001	Polypropylene	YES / JA	1
			- Retainer Discharge Valve Quad 20340000	Polypropylene	YES / JA	1
			- Suction Valve Quad 20788003	EPDM	YES / JA	4
			- Discharge Valve Quad 20372030	EPDM	YES / JA	1
3	588-209610000	20400003-S208 588-20473-S08	Pistons (Ra <0,5 µm, electro polish) Kolben (Ra <0,5 µm, elektrolytisch poliert	Stainless Steel 316L Edelstahl 1.4404	YES / JA	4
4	20369042	20407031-S1 20400003-S208 588-20473-S08	Diaphragm / Membrane	Santoprene®	YES / JA	1
5	N/A	20400003-S208 588-20473-S08	Outer Piston Plate / Kolbenplatte, außen	-	NO / NEIN	1
6	N/A	20400003-S208 588-20473-S08	Cam with stainless steel bearing Exzenter mit Edelstahlkugellager	-	NO / NEIN	1
7	92000114	20400003-S208 588-20473-S08	Grub Screw / Madenschraube	-	NO / NEIN	1
8	588-M416Z	20400003-S208 588-20473-S08	Screw (DIN912, 4 x 16, A2) Schraube (DIN912, 4 x 16, A2)	Stainless Steel Edelstahl	NO / NEIN	4
8	588-MB4	20400003-S208 588-20473-S08	Lock Washer (DIN127, B4, A2) Federring (DIN127, B4, A2)	Stainless Steel Edelstahl	NO / NEIN	4

- Above mentioned materials are free of any animal content.

6.1 Service – Kits | Wear Parts



PUREFLO® 21: # 20400003-S208 (Shaft Ø 8 mm)



PUREFLO® 21: # 588-20473-S08 (Shaft Ø 8 mm)

7 Declaration of Conformity

xylem
Let's Solve Water

Xylem Water Solutions Deutschland GmbH
Oststraße 28, 22844 Norderstedt, GERMANY
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EC Declaration of Incorporation

In accordance with the following Directive(s):

CE No. 1935/2004	Food Contact Materials
2006/42/EC	The Machinery Directive
94/9/EC	ATEX Directive

hereby declare that:
Equipment / Model number **PUREFLO® 21** Diaphragm Pumps 590-XXXX
591-XXXX
591-1203-2ATEX
591-1203-4ATEX
592-XXXX

Serial Number XXXXXXXX
is in conformity with the applicable requirements of the following documents:

Directive	Ref. No.	Title	Edition/date
FD	CE No. 1935/2004	Food Contact Materials	2004
MD	BS EN 809:1998	Pumps and pump units for liquids. Common safety requirements	1998
ATEX	94/9/EC	ATEX 137 – Group II Category 2 & 3	2003

The technical documentation for the machinery is available from:

Name: Xylem Water Solutions Deutschland GmbH
Address: Oststraße 28, 22844 Norderstedt, GERMANY

We undertake to transmit, in response to a reasoned request by the appropriate national authorities, relevant information on the partly completed machinery identified above.

The machinery is incomplete and must not be put into service until the machinery into which it is to be incorporated has been declared in conformity with the provisions of the Directive.

In compliance with the regulations (CE) No. 1935/2004, relating to materials and articles intended to come into contact with foodstuffs (repeal Directive 89/109/CEE); the materials in contact with the product do not transfer their components in quantities which may jeopardize consumers' health or safety.

I hereby declare that the equipment named above has been designed to comply with the relevant sections of the above referenced specifications and is in accordance with the requirements of the Directive(s).

Signed by:	H. Rennemann	T. Bardtke
Name:	Heiko Rennemann	Thomas Bardtke
Position	General Manager	Quality Manager
Done at	Norderstedt Site	Norderstedt Site
On	03/09/13	03/09/13

Document ref. No. DOI P21

NOTES

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